

MIL-C-3849B

21 February 1973

SUPERSEDING

MIL-C-3849A

23 May 1962

MILITARY SPECIFICATION

CORD, ELECTRICAL (TINSEL)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers tinsel cords of various constructions, suitable for use with telephones, switchboards, microphones, and associated equipment under varying atmospheric conditions.

1.2 Classification. Cords covered by this specification shall be of the classes and styles specified (see 3.1 and 6.2).

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

FSC 6145

MIL-C-3849B

SPECIFICATIONS

MILITARY

- | | |
|-------------|--|
| MIL-C-572 | - Cords, Yarns, and Monofilaments, Organic Synthetic Fiber. |
| MIL-W-3795 | - Wire, Electrical (Tinsel). |
| MIL-I-3930 | - Insulating and Jacketing Compounds, Electrical (For Cable, Cord and Wire). |
| MIL-C-12000 | - Cable, Cord, and Wire, Electric; Packaging of. |
| MIL-C-45662 | - Calibration System Requirements. |

(See Supplement 1 for list of applicable specification sheets)

STANDARDS

FEDERAL

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| FED-STD-228 | - Cable and Wire, Insulated; Methods of Testing. |
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MILITARY

- | | |
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| MIL-STD-104 | - Limits for Electrical Insulation Color. |
| MIL-STD-105 | - Sampling Procedures and Tables for Inspection by Attributes. |

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Detail requirements for individual cord classes and styles. The requirements for the individual cords under this specification shall be as specified herein and in accordance with the applicable military specification sheets. In the event of discrepancy between this specification and the requirements of the applicable military specification sheet, the latter shall govern (see 6.2).

3.2 Materials. The materials used in the construction of cords covered by this specification shall be as specified herein. When a definite material is not specified, the best material commercially available for the purpose shall be used.

3.2.1 Tinsel wire. All uninsulated tinsel wire shall be in accordance with MIL-W-3795, type I or II, as specified on the applicable specification sheet (see 3.1).

3.2.2 Fibers and yarns. All synthetic fibers and yarns employed as separator, fillers, binders, staycords and braids shall be as specified herein.

3.2.2.1 Separator. Each tinsel conductor, prior to insulating, shall be closely covered with a separator yarn of polyester, type PSTR, cellulose acetate, type AR, or polyamide, type P, per MIL-C-572. Vegetable and sulfonated oils shall not be applied as a lubricant to the textile yarns used in, or in contact with, the tinsel conductors.

3.2.2.2 Fillers and binders. Fillers and binders shall be yarn of polyamide, type P, or polyester, type PSTR conforming to MIL-C-572, or polypropylene. Fillers shall be used between insulated conductors to form an essentially circular cross-section core and to provide slippage between the insulated conductors. Binders shall be applied over the cabled tinsel wire conductors as specified on the applicable specification sheets (see 3.1).

3.2.2.3 Staycords. Staycords shall be yarn of polyamide, type P, cellulose acetate, type AR, or cellulose triacetate, type CTA per MIL-C-572. Each staycord shall consist of ply yarn, one or more braids, or yarn covered by braid. The breaking load of staycords shall be not less than 40 pounds, and the diameter shall be approximately the same as that of the insulated tinsel wire conductors in the cord. The staycords shall not abrade or otherwise damage the insulation when the cord is bent or stretched.

3.2.2.4 Outer braid. The outer braid shall be fabricated from polyamide, type P per MIL-C-572. The color of the braid shall be as specified (see 6.2).

3.2.3 Insulation. The compounds used for insulation shall be of the types specified on the applicable specification sheets (see 3.1), and shall conform to MIL-I-3930.

3.2.3.1 Insulation wall thickness. The minimum wall thickness of the insulation shall be 0.007 inch.

3.2.3.2 Diameter of insulated conductors. The diameter of each insulated conductor shall be as follows:

<u>Tinsel wire</u> <u>(type, MIL-W-3795)</u>	<u>Dia. of insulated</u> <u>conductor</u>
I	0.071 to 0.081
II	0.070 to 0.076

3.2.3.2 Insulation color coding. The color of the insulation shall conform to MIL-STD-104. The color coding of the individual insulated conductors in a core complement shall be in the following sequence:

- | | |
|----------|-----------|
| 1. Black | 4. Green |
| 2. White | 5. Orange |
| 3. Red | |

3.2.4 Jacket. The compounds used for jacketing shall be of the types specified on the applicable specification sheets (see 3.1), and shall conform to MIL-I-3930. The jacket shall be black in color unless otherwise specified (see 6.2). The jacket shall be smooth and free of surface irregularities.

3.2.4.1 Jacket wall thickness. The jacket wall thickness shall be as specified on the applicable specification sheet (see 3.1).

3.3 Outside diameter. The outside diameter of the finished cords shall be as specified on the applicable specification sheet (see 3.1).

3.4 Finished cords. The finished cords shall conform to the requirements of this specification and the applicable specification sheet (see 3.1).

3.5 Electrical requirements.

3.5.1 Dielectric withstanding voltage. The insulated conductors shall withstand, without breakdown, an applied voltage of 500 volts dc (350 volts ac, rms), when tested as specified in 4.5.2.1.

3.5.2 Insulation resistance. Immediately after the insulated conductors have been subjected to the dielectric withstanding voltage test, the insulation resistance shall be measured as specified in 4.5.2.2. The insulation resistance of each insulated conductor shall be not less than the value specified on the applicable specification sheet (see 3.1).

3.5.3 Continuity. Each conductor of the finished cord shall be continuous, when tested as specified in 4.5.2.3.

3.5.4 DC resistance. The DC resistance of each tinsel wire conductor in the finished cords shall not exceed 0.28 ohm per foot for type I and 0.25 ohm per foot for type II (MIL-W-3795), when tested as specified in 4.5.2.4.

3.6 Physical properties.

3.6.1 Breaking load. The breaking load of the finished cords shall be not less than the value specified on the applicable specification sheet (see 3.1), when tested as specified in 4.5.3.1.

3.6.2 Cold bend. The insulation of braided cords, and the insulation and jacket of jacketed cords shall not exhibit any evidence of cracks, flaws or other damage when tested as specified in 4.5.3.2.

3.6.3 Sea-water resistance. When so specified on the applicable specification sheet (see 3.1), the finished cord shall be tested for sea-water resistance as specified in 4.5.3.3. The weight change of the cord shall be not more than 5 milligrams per square inch of wetted surface, and there shall be no evidence of chemical reaction or other deleterious effects to the jacket when visually examined.

3.7 Workmanship. Cords shall be constructed and finished in a thoroughly workmanlike manner in accordance with accepted high grade production techniques. The cords shall be a uniform and consistent product and shall be free from any defects which will adversely affect the serviceability of the product, such as lumps, kinks, splits, abrasions, scrapes, corroded surfaces, skin impurities and faulty extruded surfaces.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Inspection equipment and facilities. Inspection equipment and facilities shall be established and maintained in accordance with MIL-C-45662.

4.2 Classification of inspections. The examinations and tests of cords are classified as follows:

- (a) Materials inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).
 - 1. Inspection of product for delivery (see 4.4.1).
 - 2. Inspection of preparation for delivery (see 4.5.4).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table I, used in fabricating the designated cord type classes (see 3.1), are in accordance with the applicable referenced specification or requirements prior to such fabrication.

Table I. Materials inspection.

Material	Requirement paragraph	Applicable specification
Tinsel wire	3.2.1	MIL-W-3795
Separators, fillers, binders, and staycords	3.2.2.1, 3.2.2.2, 3.2.2.3	MIL-C-572
Outer braid	3.2.2.4	MIL-C-572
Insulation	3.2.3	MIL-I-3930
Jacket	3.2.4	MIL-I-3930

4.4 Quality conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection. Delivery of products which have passed the group A inspection shall not be delayed pending the results of the group B inspection.

4.4.1.1 Inspection lot. An inspection lot shall consist of all cords of the same type class (see 3.1) produced under essentially the same conditions and submitted for inspection at the one time.

4.4.1.2 Unit of product. The unit of product, for purposes of sampling, shall be each continuous length of cord as specified in the contract or order.

4.4.1.3 Sample. The sample shall consist of that number of randomly selected units of product required by the applicable sampling plan for the presented lot.

4.4.1.4 Sample units. A sample unit is a unit of product which forms part of the sample from which specimens are taken for inspection.

4.4.1.5 Specimen. A specimen may be the entire sample unit or any portion of the sample unit which is to be subjected to inspection.

4.4.2 Group A inspection. Group A inspection shall include the examinations and tests of table II, subgroups I and II.

4.4.2.1 Major and minor defects. Major and minor defects shall be as defined in MIL-STD-105 and as classified below. This listing is intended as a guide and should not be construed as being all-inclusive. Any sample unit which has one or more major or minor defects shall be a "defective".

Major defects -

Missing or broken strands in tinsel wire.
 Materials not as specified herein.
 Nicks, rips, cuts, occlusions, or other similar defects in insulation or jacket.
 Insulation improperly centered over tinsel wire.
 Color coding not as specified.
 Jacket improperly centered over cord core.
 Dimensions not as specified.

Minor defects -

Incompleteness of separator coverage.
 Insulation surface unsmooth.
 Shade of color for color coding not as specified.
 Marking not as specified.

4.4.2.2 Subgroup I. For subgroup I, the acceptable quality level (AQL) shall be as specified in table II and the inspection level shall be level II in accordance with MIL-STD-105. Subgroup I tests may be performed in any order.

4.4.2.3 Subgroup II. For subgroup II, the AQL shall be as specified in table II and the inspection level shall be level II in accordance with MIL-STD-105. Subgroup II tests shall be performed in the order shown in table II.

4.4.2.4 Rejected lots. If an inspection lot is rejected, the supplier may withdraw the lot from further inspection. The supplier may also rework a rejected lot to correct the defects or screen out the defective units and reinspect the lot using tightened inspection. Rejected lots shall be kept separate from new lots and shall not lose their identity.

Table II. Group A inspection.

Examination or test	Requirement paragraph	Test Method paragraph	AQL (Percent defective)	
			Major	Minor
<u>Subgroup I</u>				
<u>Visual and dimensional</u>				
Construction	3.1	4.5.1	1.0% for the group combined	4.0% for the group combined
Materials	3.2			
Insulation wall thickness	3.2.3.1			
Diameter of insulated conductors	3.2.3.2			
Insulation color coding	3.2.3.3			
Jacket wall thickness	3.2.4.1			
Outside diameter	3.3			
Workmanship	3.7			
<u>Subgroup II</u>				
<u>Electrical</u>				
Dielectric withstanding voltage	3.5.1	4.5.2.1	1.0% for the group combined	*
Insulation resistance	3.5.2	4.5.2.2		
Continuity	3.5.3	4.5.2.3		
DC resistance	3.5.4	4.5.2.4		

*All electrical defects are considered major.

4.4.3 Group B inspection. This inspection shall consist of the tests specified in table III and shall be performed periodically as indicated in 4.4.3.1. Samples shall be selected from lots that have passed group A inspection.

4.4.3.1 Sampling for inspection. One sample shall be selected per each 10,000 feet of finished cords or fraction thereof, with a minimum of 3 samples, and not to exceed a total of 5 samples per order. Samples shall be selected periodically through the life of the contract to assure representative results.

Table III. Group B inspection.

Examination or test	Requirement paragraph	Test Method paragraph
Breaking load	3.6.1	4.5.3.1
Cold bend	3.6.2	4.5.3.2
Sea-water resistance	3.6.3	4.5.3.3

4.4.3.2 Noncompliance. No failures shall be allowed in group B inspection. If a sample unit fails to pass group B inspection, the supplier shall take corrective action on the material or process or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the government, has been taken. After the corrective action has been taken, group B inspection shall be repeated on additional sample units (all inspections or the inspection that the original sample failed, at the option of the government). Group A inspection may be reinstituted; however, final acceptance shall be withheld until the group B reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant inspection activity.

4.5 Test methods.

4.5.1 Visual and dimensional inspection. The finished cords shall be given a visual and dimensional inspection for conformance with the applicable requirements of table II, subgroup I.

4.5.2 Electrical tests.

4.5.2.1 Dielectric withstanding voltage (see 3.5.1). The finished cords shall be tested as specified in FED-STD-228, method 6111, except for the following:

- (a) The test shall be performed on finished cords only.
- (b) The immersion period shall be not less than 9 hours.
- (c) One terminal shall be each conductor in turn, and the other terminal shall be all the remaining conductors tied together in electrical contact with the water.

4.5.2.2 Insulation resistance (see 3.5.2). The insulation resistance of the finished cords shall be determined as specified in FED-STD-228, method 6031, except for the following:

- (a) The test shall be performed on finished cords only.
- (b) The immersion period shall be not less than 9 hours.
- (c) The test voltage shall be not less than 500 volts dc.
- (d) The polarity of the conductor shall be maintained negative with respect to the water. One terminal shall be each conductor in turn, and the other terminal shall be all the remaining conductors tied together in electrical contact with the water.
- (e) If the measurement is made at a temperature lower than 15.6°C, the supplier shall correct the measured value of insulation resistance to the resistance at 15.6°C.

4.5.2.3 Continuity. Each conductor of the finished cord shall be tested for continuity using a maximum test voltage of 10 volts, and shall meet the requirements of 3.5.3.

4.5.2.4 DC resistance. The DC resistance of each conductor shall be determined in accordance with FED-STD-228, method 6021, and shall meet the requirements of 3.5.4.

4.5.3 Physical tests.

4.5.3.1 Breaking load. The finished cords shall be tested as specified in FED-STD-228, method 3211, except for the following:

- (a) Each test specimen shall be the whole cord. Each specimen shall be 1 foot in length, cut from the sample unit.
- (b) The test specimens shall be subjected to the tensile strength test only.

The breaking load of the test specimens shall meet the requirements of 3.6.1.

4.5.3.2 Cold bend. Each specimen for the cold bend test shall be divided into two parts, one for checking the finished (jacketed) cord as a whole, and the other for checking the insulated conductors apart from the finished cord. After completion of the cold bend tests specified in 4.5.3.2.1 and 4.5.3.2.2, the jacketed specimens and the insulated conductor specimens shall meet the requirements of 3.6.2.

4.5.3.2.1 Jacketed cord. The specimens selected for checking the cord as a whole shall be attached to the proper size mandrel, as specified in table IV, and shall be suspended vertically with lower ends weighted sufficiently to keep specimens taut and to permit bending them without handling. The mandrels and specimens shall be placed in the cold chamber for at least 20 hours at the temperature specified on the applicable specification sheet (see 3.1). While at this temperature, the specimens shall be bent for 5 close turns around the mandrel at the rate of approximately 1 turn per second. After the test has been completed, the jacket shall be examined through a magnifying glass of at least 3X magnification for cracks, flaws or other damage. The jacket shall then be removed, and the insulation beneath the jacket shall be examined in a like manner.

4.5.3.2.2 Insulated conductors. The specimens selected for checking the insulation apart from the cord shall have the jacket (or braid) removed, and each insulated tinsel wire conductor shall be tested and examined in accordance with the procedures specified in 4.5.3.2.1.

Table IV. Mandrel sizes for cold bend tests.

Outside diameter of specimen	Outside diameter of mandrel
<u>Inch</u>	<u>Inch</u>
0.000 to 0.090	1/16
.091 to .125	3/32
.126 to .180	1/8
.181 to .240	1/4
.241 to .300	3/8
.301 to .360	1/2

4.5.3.3 Sea-water resistance. One specimen from each sample unit, at least 3 feet in length, shall be weighed and the weight recorded. The specimen shall then be immersed in a salt-water solution composed of distilled water and a 3-1/2 percent solution of sodium chloride for a period of 10 days at room temperature. After removal from the solution, each specimen shall be wiped clean and weighed again to determine weight change before and after immersion. The specimens shall also be examined for evidence of chemical reaction or other deleterious effects. The specimens shall meet the requirements of 3.6.3.

4.5.4 Inspection of preparation for delivery. Sample packages or packs and the inspection of the preservation, packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing and marking shall be in accordance with MIL-C-12000. (See 6.2(g).)

6. NOTES

6.1 Intended use. The cords covered by this specification are intended for low-voltage, audio-frequency use, where extreme flexibility is required. These cords are primarily for use with telephones, switchboards, microphones, and associated communications equipments.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Title, number and date of applicable specification sheet (see 3.1).
- (c) Class and style of cord, and number of tinsel wire conductors required (see 3.1).

- (d) Color code of outer braid, if applicable (see 3.1 and 3.2.2.4).
- (e) Color code of jacket, if other than black (see 3.2.4).
- (f) Length and quantity of finished cords to be delivered.
- (g) Level of packaging and level of packing required (see 5.1).

6.2.1 Indirect shipments. The preservation, packaging, packing and marking specified in Section 5 apply only to direct purchases by or direct shipments to the government, and are not intended to apply to contracts or orders between the supplier and prime contractor.

Custodians:

Army - EL
Navy - SH
Air Force - 17

Preparing Activity:

Army - EL

Project No. 6145-0624

Review Activities:

Army - EL
Navy - SH, YD
Air Force - 17, 80
NSA
IS

User Activities:

Army - MU
Navy - MC, MS, SA

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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 22-R255
<p>INSTRUCTIONS: This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.</p>		
SPECIFICATION <u>MIL-C-38498 CORD, ELECTRICAL (TINSEL)</u>		
ORGANIZATION		
CITY AND STATE	CONTRACT NUMBER	
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO (If "yes", in what way?)		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity - Optional)		DATE

DD FORM 1426
1 JAN 61

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.

ESC-FM 1068-68